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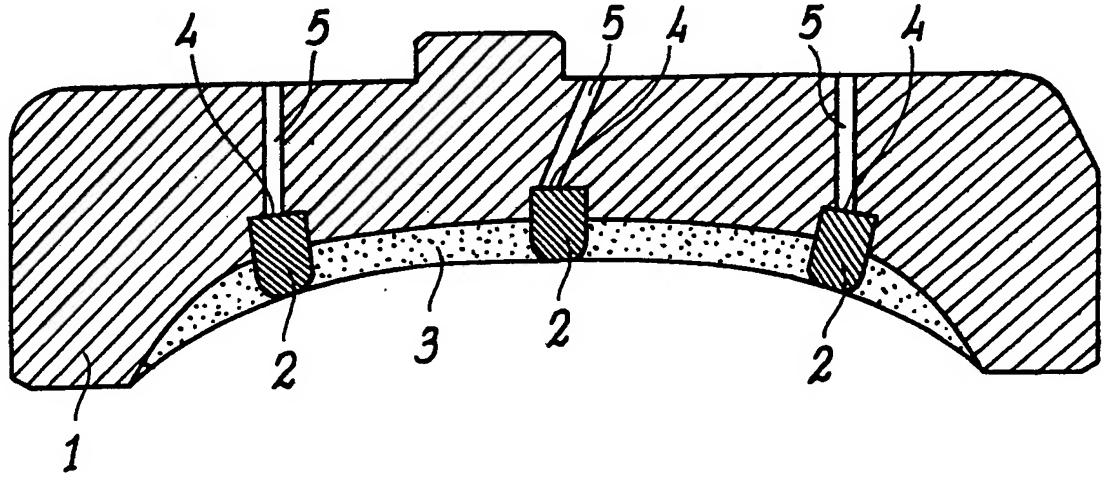

(57) Abstract

Tire mold with traceless venting, showing a set of relief ribs (2, 3), corresponding to pattern to be impressed on tread on molding and curing, in which at least a part of said ribs are made from a porous metallic material, suitable for air and gas venting, and are rigidly secured to mold (6) at their bases (4), and in which there is provided a plurality of channels (5) linking said bases (4) with the outside, through the mold body, for venting the air expelled through said porous ribs (2, 3) on molding.

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TIRE MOLD WITH TRACELESS VENTING

This invention refers to a tire mold with traceless venting. More particularly, the invention refers to implementation, within a tire mold, of an improved system for venting air and gas on molding, and for conveying them outside.

As already known, the typically grooved and carved pattern of tires' treads is obtained through the molding and curing operation, in which the raw tire is inserted in a suitable mold and subjected to some strong pressure from inside, causing it to adhere perfectly to mold, thus receiving the impression of tread and sidewalls.

In order to correctly carry outsaid operation it is required that any air initially contained within the mold be not trapped between the latter and the rubber upon molding, and therefore some venting system is to be provided allowing its expulsion, without however letting the rubber itself to escape.

This system is presently implemented in most various ways, by providing some thin slits or pinholes or passages of sundry types upon the inside surface of the mold, which are linked, often in a quite complex way, with the outside.

One solution lies in providing hundreds of small cross through channels, in the base of the protruding ribs forming the pattern to be impressed on tread. Through said small channels communication is obtained among the different air pockets formed between one rib and another, on curing. Besides, several pinholes are provided, passing through the mold and allowing to vent the air outside. In practice, said pinho-

les are made by holes of, for instance, 2.5 mm. diameter in which, in order to reduce their cross section, as many bushes are introduced, having an inside diameter of about 0.75 mm.

The extremely reduced dimension of openings provided on mold should allow the air venting without any penetration of rubber; however, in practice, rubber enters all the same and finished tires show a series of small, protruding tubular appendices, corresponding to mold's canalizations.

Besides, it clearly appears how much this system is complex and costly to carry out: before all, the dimensioning and localization of small channels call for long and complicated study, and, besides, the implementation itself of mold results to be quite delicate and costly.

Another solution is that of making the mold in several thin transversal segments, placed side by side, so that air might escape from it through the slits among said segments. However, this implementation calls for extreme precision in machining the segments, which are to be mutually approached to make up the mold, thus perfectly matching.

Actually, should slits among segments be too wide, rubber could pass through them, thus forming some cross flashes on tread's surface. Such difficulty, however, cannot be completely eliminated and tires obtained by this method show anyway some traces in correspondence with mold's slits.

Alternatively, the so-called "spaghetti venting" is made use of, which consists in providing very thin, continuous longitudinal grooves along the base of both sidewalls of the ribs, where the latter are connected with the bottom of the mold. Several through pinholes, communicating with the outside, are provided in said grooves. Air therefore gathers in said small channels and is vented outside through pinholes.

Even in this case the solution is non marginally costly, above all because grooves, owing to precision required, should be hand made.

There are difficulties also in the solution by which ribs are formed by parts separated from basic mold and secured to same through bolts; under the rib's base there is provided, on the mold, a continuous central groove, and air, when entering the slit between the rib's base and the mold surface, gathers in said groove and is vented outside through suitable canalizations. In this case there is first of all the problem of dissimulating the traces of bolts from rib's top and, besides, the coupling between latter and the mold is to be provided with extreme precision, still to avoid that too wide slits be formed. This is specially difficult mostly owing to the fact that mold shows a twin curving, in peripheral and cross senses.

It appears that such multiplicity of solutions presently adopted for air venting in curing tires, shows how none of them has been particularly successful by economy or quality of product.

It is therefore an object of this invention to provide a tire mold allowing the air venting without giving way to traces on molded product surface and being at the same time easy and cheap to manufacture.

According to the invention, there is proposed to make the relief parts of the mold, all or part of them, from a porous metallic material, securing them rigidly to the mold, not necessarily in a way allowing disassembly, and connecting them, at their bases, with a system of channels passing through the mold and in communication with the outside. Air can therefore be vented from mold by passing through pores of the material, without any presence of pinholes or slits on inside surface. Any shortcoming relating to manufacturing difficulties or to traces on molded tire, as caused by pinholes or slits, is therefore avoided.

The present invention specifically relates to a tire mold with traceless venting, showing a series of relief ribs, corresponding to pattern to be impressed on tread on molding and curing, characterized in that at least a part of said ribs are made from a porous metallic material, suitable for air and gas venting, and are rigidly secured to mold at their bases, and in that there is provided a plurality of channels linking said bases with the outside, through the mold body, for venting the air expelled through said porous ribs on molding.

Preferably said porous material is sintered stainless steel, for instance AISI 304/316 steel, whose pores have an average dimension between 5 μm and 50 μm, while porosity varies between 25 % and 40 %.

In particular, according to a preferred embodiment, pores have an average dimension of 15 μm, while porosity equals 25 %.

When the mold is a steel one, ribs are inserted with their bases into suitable grooves provided on its bottom, and they are secured by welding; in case of aluminium alloy molds, on the contrary, the ribs can be embodied with their bases merged into the mold, directly upon molding by fusion of mold itself.

According to a further embodiment, ribs are secured to mold through screws or bolts, being anyway inserted with their bases within suitable grooves in the mold; said solution allows the disassembly of elements, in order to replace them whenever required.

It clearly appears that the mold according to this invention, in its various embodiments, is more simply and cheaply manufactured than those of known techniques. Besides, even in case that grooves are provided within the base mold, it is not required any high precision and in no case the surfaces to be matched show any multiple or complex curving.

Compared to the venting systems including various types of pinholes and small channels, the one according to this invention has

the advantage of leaving no trace on tire, while providing a surface available for venting which is quite greater.

Besides, it is not required that all projections be made from porous material; for instance the porous zones can be advantageously limited to transversal ribs only: in such a way each of the separated air pockets formed during molding is in contact with at least two porous zones. In this way, the different types of segments to be made from porous material are less than for the peripheral ribs, thus allowing a greater standardization of mold manufacture as well as a reduction of tooling costs.

Porosity is selected in such a way that rubber cannot enter the pores, and therefore the material is not jammed inside, even if some of it can stick on the outside surface, like on the whole remainder of mold.

Whenever surface cleaning is needed, it is only required to operate according to known methods, for instance by blasting of beads, or by using chemical agents, or else by adopting this latter cleaning once in a while, among more frequent blasting operations.

The invention will be now described, for illustrative and not limitative purposes, with reference to figures of the enclosed drawings, in which:

figure 1 shows a cross sectional view of a first embodiment of the mold according to the invention; and

figure 2 shows a cross sectional view of a second embodiment.

In figure 1 there is shown one section of a segmented mold for tires, formed by a main body 1, made, for instance, from aluminium alloy.

Longitudinal ribs 2, made from sintered steel, are shown in cross section, while by 3 a porous transversal rib is shown in lateral

view.

As it can be remarked, ribs 2 are inserted, up to some length, into body 1 of the mold, while they are joined to the outside, at their bases 4, through channels 5. The same happens for cross ribs 3 (not shown).

The coupling of the ribs to the mold in the embodiment shown is provided, as already stated, by burying the porous steel elements in the aluminium mass upon fusion molding.

According to this solution all ribs shown are made from porous material, but is is to be understood that this could be limited, for instance, only to the cross ones.

In figure 2 there is shown a tread crown 6 of a two-halved tire mold, where longitudinal and cross ribs, their bases and channels are shown by same numerals as in figure 1.

This invention has been described with special reference to some of its preferred embodiments, but is to be understood that modifications and changes might be made by those skilled in the art without departing from its gneral scope.

CLAIMS

1. Tire mold with traceless venting, showing a set of relief ribs, corresponding to pattern to be impressed on tread upon molding and curing, characterized in that at least a part of said ribs are made from a porous metallic material, suitable for air and gas venting, and are rigidly secured to mold at their bases, and in that there is provided a plurality of channels linking said bases with the outside, through the mold body, for venting the air expelled through said porous ribs on molding.

2. Tire mold according to claim 1 in which said porous metallic material is sintered stainless steel.

3. Tire mold according to claim 2 in which pores of said steel have an average dimension between 5 μm and 50 μm.

4. Tire mold according to claim 3 in which porosity of said steel varies between 25 % and 40 %.

5. Tire mold according to claim 4 in which said pores have an average dimension of 15 μm while said porosity equals 25 %.

6. Tire mold according to any of claims 1-5 in which said mold is made from steel and said porous ribs are inserted with their bases into suitable grooves provided on mold bottom and are secured by welding.

7. Mold according to any of claims 1-5 in which said mold is made from aluminium alloy and said porous ribs are embodied with their bases merged into the mold directly on fusion molding of same.

8. Mold according to any of claims 1-5 in which said porous ribs are inserted with their bases into suitable grooves provided on mold botom and are secured through screws or bolts.

9. Tire mold according to any of previous claims in which cross

ribs only are made from said porous metallic material.

10. Tire mold with traceless venting according to claim 1-9 substantially as previously described and shown.

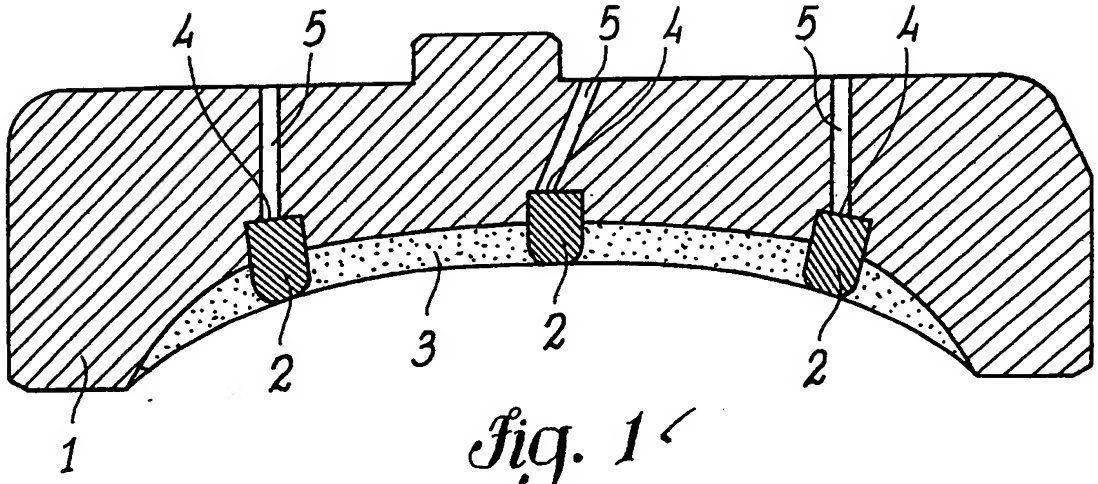

Fig. 1

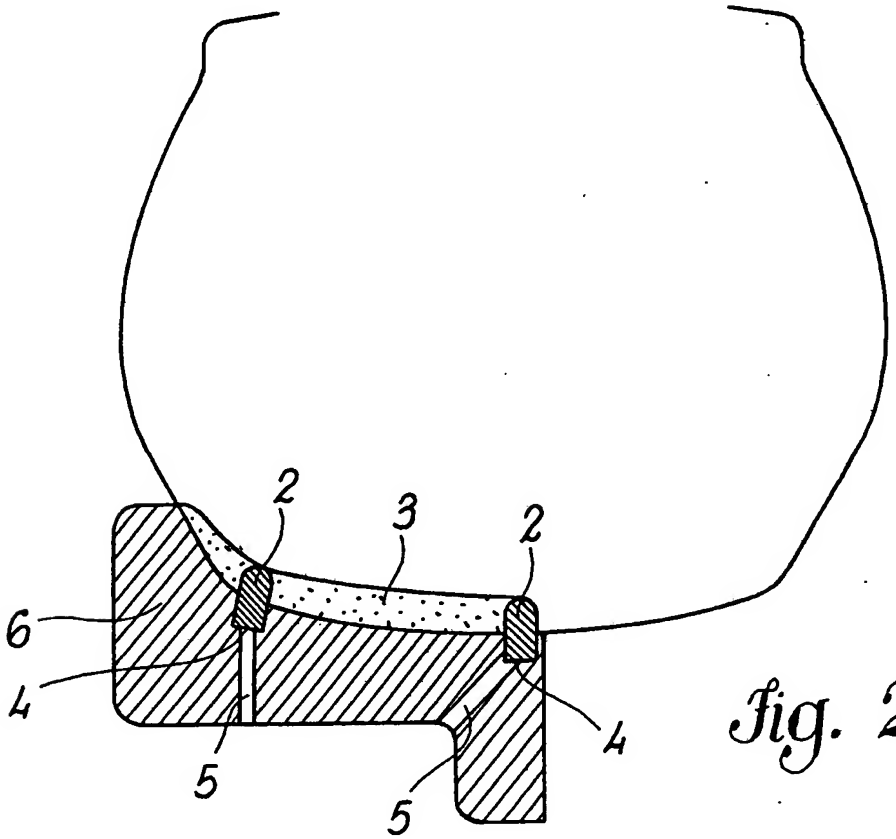

Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/IT 87/00072

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: B 29 C 33/10

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	B 29 C B 29 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	GB, A, 840883 (DUNLOP) 13 July 1960 --	1-10
X	DE, C, 1200518 (CONT. GUMMI) 9 September 1965 --	1-10
X	GB, A, 664730 (PIRELLI) 9 January 1952 --	1-10
A	US, A, 4436497 (J. DAHL) 13 March 1984	1

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* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24th September 1987	16 OCT 1987
International Searching Authority	**Signature of Authorized Officer**
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/IT 87/00072 (SA 17992)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 30/09/87

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 840883		None	
DE-C- 1200518		None	
GB-A- 664730		None	
US-A- 4436497	13/03/84	None	